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23 July 2015

Understanding the Cascadia Subduction Zone:

Earthquakes are unpredictable, dangerous occurrences that have the potential to rattle populations. Despite science's inability to predict earthquakes, learning more about the rocks making up the land where earthquakes have occurred in the past, faults, can allow us anticipate the size, frequency, and behavior of earthquakes along a fault. This is particularly important when these areas lie near large cities.

The surface of the earth is split into a various tectonic plates, which are either oceanic or continental. The plates move relative to one another, leading to phenomena such as earthquakes and volcanoes. Particularly, earthquakes are created when plates push or pull on one another, but get stuck, creating stress between the two plates that is resolved in a big jolt - the earthquake. This buildup of stress and sudden resolution is similar to the way you bend a stick over your knee to break it, where it first slowly creeps, then suddenly snaps.

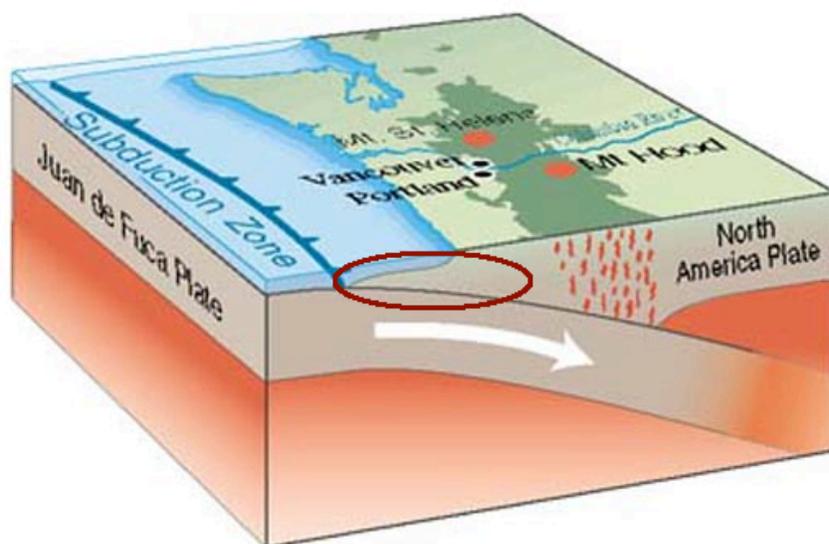


Figure 1. Simple model of the Cascadia subduction zone. The tan Plates represent the Earth's crust (This is the structure being studied). Earthquakes are mostly generated along the part of the fault encompassed by the brown circle. Image modified from the USGS.

One way tectonic plates move is for an oceanic plate to sink underneath a continental plate as the two plates converge, called a subduction zone. Subduction zones create the largest earthquakes observed on the earth, such as the frequent earthquakes in Japan and Chile, so understanding these boundaries is crucial for the protection of populations near them. Along the coasts of Washington, Oregon, and northern California, the Juan de Fuca plate is being subducted (sinking) under the North American plate at the Cascadia subduction zone. The structure of the deep crust of the North American plate along Cascadia subduction zone is poorly understood because very few earthquakes have occurred along the subduction zone recently, limiting other geophysical analyses that require nearby earthquakes.

The subject of seismology analyzes the arrivals of earthquake waves at the surface of the earth that are recorded after the shaking of an earthquake and can be used to image the structure of the earth beneath the surface. Hannah Krueger and Erin Wirth from the University of Washington are using seismic techniques to study the structure of the crust of the North American plate along the Cascadia subduction zone. Their study will provide insight into the minerals present in the subduction zone. Seismic waves travel differently through different minerals, resulting in a particular pattern in the seismogram and allowing for the interpretation of minerals based on this pattern. Think about how different someone yelling at you in the open air compared to underwater sounds, this is because the sound wave travels differently through water and air. Similarly, seismic (earthquake) waves travel differently through different types and layers of rocks. These differences can help us learn how the subduction zone works and the earthquakes it has the potential to produce. The better scientists understand the way the subduction zone works, the better communities can prepare for the terrible possibility of a large earthquake by making buildings stronger and educating people.